

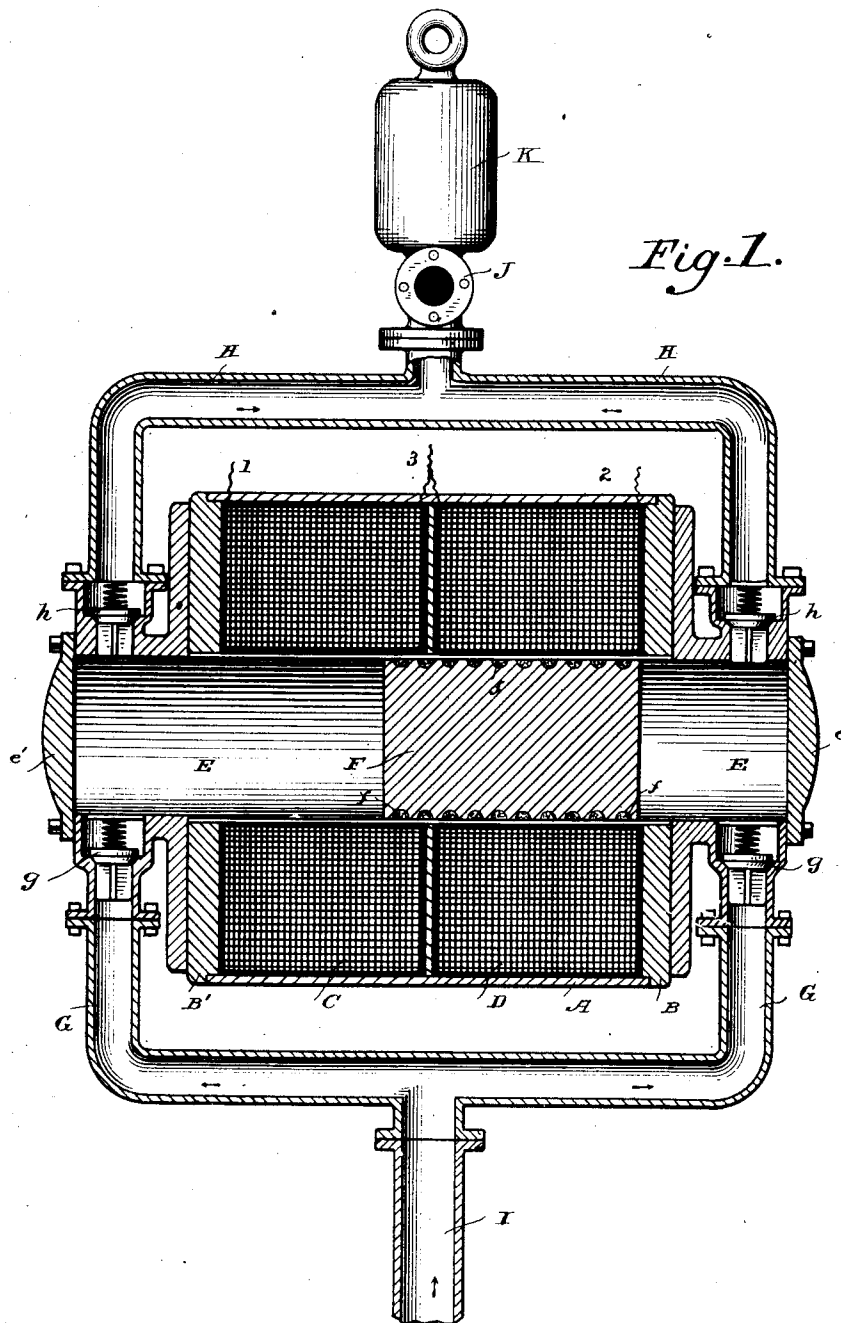
(No Model.)

C. J. VAN DEPOELE.
ELECTRICALLY ACTUATED PUMP.

2 Sheets—Sheet 1.

No. 461,295.

Patented Oct. 13, 1891.



Witnesses
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(No Model.)

2 Sheets—Sheet 2.

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Fig. 3.

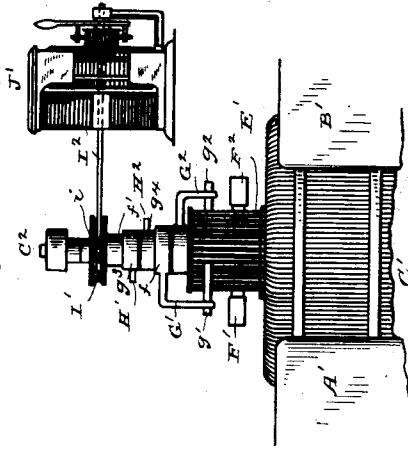


Fig. 2.

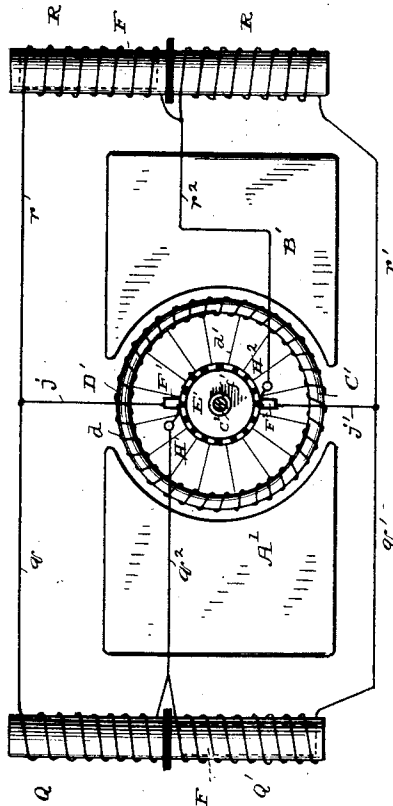


Fig. 6.

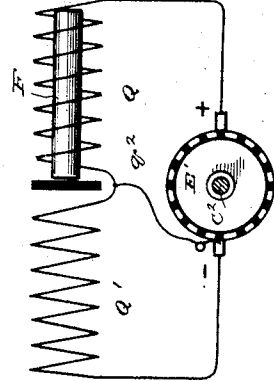


Fig. 5.

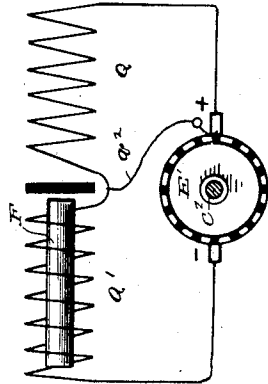
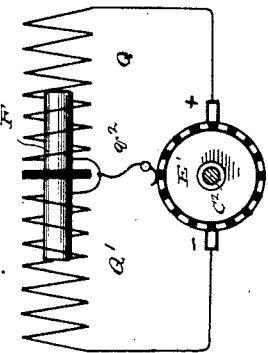


Fig. 4.



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UNITED STATES PATENT OFFICE.

CHARLES J. VAN DEPOELE, OF LYNN, MASSACHUSETTS.

ELECTRICALLY-ACTUATED PUMP.

SPECIFICATION forming part of Letters Patent No. 461,295, dated October 13, 1891.

Application filed March 27, 1891. Serial No. 386,608. (No model.)

To all whom it may concern:

Be it known that I, CHARLES J. VAN DEPOELE, a citizen of the United States, residing at Lynn, in the county of Essex and State of Massachusetts, have invented certain new and useful Improvements in Electrically-Actuated Pumps, of which the following is a description, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

My invention relates to the class of reciprocating electric engines; and it consists of an electrically-actuated pump.

The invention is embodied in an apparatus comprising solenoids or motor-coils surrounding a diamagnetic tube or cylinder, within which is placed a piston or plunger of magnetic material. The cylinder is provided with valved connections, and means are also provided for supplying current to the motor-coils, so as to produce therein a shifting field of force, under the influence of which the magnetic piston is moved back and forth within the diamagnetic cylinder, which latter, being suitably connected, becomes a pumping-engine for lifting or forcing liquids. The motor-coils may be constructed or arranged and supplied with current in any desired manner, the invention not being limited to any special arrangement of the electro-magnetic features. The said motor-coils may advantageously be arranged as set forth in my patent, No. 422,855, March 4, 1890, or with any of the relative arrangements of coils and piston set forth in my numerous subsequent applications for Letters Patent. For convenience of illustration, however, I have shown and will describe an electrical apparatus employing two motor-coils in which current is caused to alternately rise and fall, as set forth in my said patent.

In the drawings, Figure 1 is an elevation, partly in section, showing an electrically-actuated pump embodying the invention. Fig. 2 is an elevation, partly in diagram, showing a generator and two working circuits extending therefrom, each circuit including an electro-magnetic pumping-engine. Fig. 3 is a top plan view of a portion of the generator seen in Fig. 2, and showing also a motor and connections therefrom for operating the rotating brushes upon the commutator of the genera-

tor. Figs. 4, 5, and 6 are diagrammatic views illustrating the changes of position of the solenoid corresponding to the different positions taken by the rotating brush.

In Fig. 1, A is the exterior iron envelope or shell. B B' are iron heads fitted to said shell.

C D are solenoids or motor-coils, which are inclosed within the cylinder formed by the shell A and heads B B', said coils being of properly-insulated wire and thoroughly insulated from their environment. The outer terminals of the coils C D are represented by conductors 1 and 2, and following the analogy of my previous patent the inner terminals of said coils are united and connected to the intermediate conductor 3. A cylinder E of diamagnetic metal, as brass, of any desired diameter and of a thickness sufficient to withstand the working pressure, is fitted within the coils C D, the coils of course being constructed with reference to the diameter of the cylinder to be used. A core, plunger, or piston F, of magnetic material, is fitted to move within the cylinder E, and according to the present invention is also provided with suitable packing f, adapted to maintain a liquid-tight joint between the piston and the cylinder.

The cylinder E is desirably of sufficient length to extend beyond the heads B B', and is itself provided with heads e e', and also with pipe connections G H, which said connections are provided with suitable valves g h, pipes G being provided with an inlet I, and the pipes H with an outlet J, and also with an air-chamber K, if required.

As indicated, A' B' are the polar extensions of the field-magnet system of the generator, and between which an armature C', of the Gramme or any other suitable type, is rotatively mounted. The core D' of the armature is wound with continuous conductor d, connected by terminals d' with the segments of a sectional commutator E', as in the well-known Gramme armature. The face of the commutator E' is made long enough to receive two sets of brushes, one (the main) being stationary and the other movable, and by "stationary" is meant remaining in the desired position upon the line of commutation, although they will of course be adjustably sus-

tained, and said brushes can be single or double.

$F' F^2$ are the stationary brushes, desirably of carbon. The brushes $F' F^2$ are placed upon the line of commutation and occupy that part of the commutator nearest the armature. Upon the armature-shaft C^2 is placed a rotating-sleeve f' , insulated from the shaft and provided with a pair of metallic arms $G' G^2$, extending rearward to opposite points below and above the commutator, and at the extremities of said arms a second set of commutator-brushes $g' g^2$ are secured. The brush-holders $G' G^2$ are carefully insulated, each from the others, upon their common bearing f' , and adjacent to the axis of each is located a collector-ring $g^3 g^4$, one of said rings being in electrical connection with the brush g' and the other with the brush g^2 . Collector-brushes $H' H^2$ bear upon the collector-rings $g^3 g^4$, and from said brushes extend working conductors $q^2 q^3$, as will appear. The sleeve f' , together with the brush-holders and collector-rings attached thereto, is mechanically rotated, thereby causing the commutator-brushes $g' g^2$ to travel around the commutator toward and away from the points of maximum and zero electro-motive force, and to collect or convey currents of a duration dependent upon the speed with which the said brushes are moved about the commutator. The sleeve f' may be rotated in any convenient manner, the specific means being immaterial; but in Fig. 3 it is shown as provided with a worm-wheel I' , which is engaged by worm i upon a driving-shaft I^2 . The shaft I^2 may be an extension of the armature shaft of an electric motor J' , by which the shaft, worm-wheel, sleeve, and commutator-brushes may be rotated at any desired speed, suitable means being provided for regulating the motor. Where but one moving brush is required one of the brush-carriers and contact devices therefor (shown in Fig. 3) will be omitted.

In Fig. 2 the conductor j , extending from main brush F' , is bifurcated, one part q leading to one motor-coil Q and the other r to motor-coil R of separate double-coil engines comprising motor-coils $Q Q'$ and $R R'$. The conductor j' from main brush F^2 likewise divides and extends by conductor q' to motor-coil Q' and by conductor r' to motor-coil R' , returning from said coils to the moving brushes by conductors $q^2 r^2$, connected, respectively, to brushes $H' H^2$. With the positions shown the currents are maximum in coils $Q' R$, the succeeding half-rotations of the brushes $H' H^2$ reversing the conditions. With this construction and arrangement it will be understood that the rise and fall of potential in the working circuits will, with proper circuits and connections, result in alternately reducing the power in the motor-coils of reciprocating engines, which will thereby be caused to operate in synchronism with the source of supply-current and perform useful work.

Figs. 4, 5, and 6 show the different positions of the magnetic plunger corresponding with different positions of the moving brushes. In Fig. 4 the moving brush is equidistant between the stationary brushes. Consequently there is no more tendency of the current to flow through the intermediate conductor q^2 in one direction than another, and the whole current flows from the positive brush through both motor-coils and back to the negative brush. The inner terminals of the motor-coils being united at the point of their connection with the intermediate conductor q^2 will with this arrangement be practically in series and form one long coil, within which the magnetic piston will take position at the point of magnetic equilibrium. As the moving brush travels toward one of the stationary brushes the flow of current will be decreased in one coil and increased in the other, until, as indicated in Fig. 5, the moving brush having reached a position opposite to the main negative brush all the current will flow from the positive brush through the coil Q , and thence through the intermediate conductor q^2 to the negative side of the commutator, the position of the magnetic plunger F being then central within the coil Q . As the moving brush travels away from the negative and toward the positive brush the current falls in the coil Q and rises in the coil Q' until the said moving brush reaches a position opposite to the positive brush, as indicated in Fig. 5, when the whole current will flow through the intermediate conductor q^2 from the positive side of the commutator, through the coil Q' , and back to the main negative commutator-brush. The magnetic plunger F moves through the coils $Q Q'$ precisely in accordance with the transfer of current from one coil to the other. This being effected as described, it follows that the magnetism of the plunger is never changed or varied to any perceptible extent, and therefore a regular steady movement of said piston takes place, the piston following the movement of its magnetic field and being wholly unable to escape therefrom.

No particular form of generating-armature or source of rising and falling current is essential so long as the principles herein set forth are followed.

Upon supplying the coils $C D$ alternately with defined rising and falling currents the field of force of one coil will gradually increase in strength while that of the other coil is diminishing, and under these circumstances the piston F will be attracted first in one direction and then in the other, and being properly packed and fitted within the cylinder E will perform the same function as the piston of an ordinary pump, forcing out and drawing in liquids through the pipes $I G$ and $H J$. While I have referred to the motor-coils C and D as merely two coils, they may be further designated as "front" and "back" coils, and it will be readily understood that said coils

and may be further subdivided wherever desired for electrical reasons, the said groups of coils, however arranged, being adapted when energized to respectively move the piston in one direction or the other, and which, for the sake of convenience, will be hereinafter referred to as the "front" and "back" coils.

Many modifications of the valves and other appurtenances incident to the moving of the liquid to be operated upon may be made without in any way departing from the invention, which resides principally in the direct combining, with a piston, of electro-magnetic means for actuating the same. I believe myself to be the first to directly apply the force of electro-magnetism to a piston moving within a cylinder and itself performing work without any mechanical connections whatever, and I therefore claim the same, broadly.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. An electrically-actuated pump comprising a diamagnetic pump-cylinder, a piston therefor of magnetic material, motor-coils upon the exterior of the cylinder for moving the piston in opposite directions, and means for supplying current having a defined rise and fall to the coils in alternation.

2. An electrically-actuated pump comprising a valved pump-cylinder of diamagnetic material, a packed magnetic piston therefor, motor-coils arranged upon the exterior of the cylinder, and means for supplying defined phases of current to the motor-coils in alternation to reciprocate the piston within the cylinder.

3. An electrically-actuated pump comprising motor-coils, a pump-cylinder of diamagnetic material within said coils, a packed magnetic piston within the cylinder, suitable valves and connections to the pump-cylinder, and means for supplying defined phases of current to and shifting the field of force of the motor-coils alternately to reciprocate the pump-piston within the cylinder.

4. An electrically-actuated pump comprising a diamagnetic pump-cylinder provided with suitable valves and connections, a magnetic piston therein, motor-coils upon the exterior of the cylinder, and means, substantially as described, for supplying defined rising and falling currents to the motor-coils in alternation, thereby creating a shifting field of force therein, under the influence of which the piston is reciprocated within the cylinder.

5. An electrically-actuated pump comprising a diamagnetic cylinder, a packed piston therefor, said piston being a magnetic mass movable within the cylinder, valves and connections for said cylinder, a plurality of motor-coils upon the cylinder, an iron envelope inclosing said coils, and means for supplying defined phases of current alternately to the front and back coils, thereby creating a shifting field of force, under the influence of which the piston is reciprocated within the cylinder.

In testimony whereof I affix my signature in presence of two witnesses.

CHARLES J. VAN DEPOELE.

Witnesses:

JOHN W. GIBBONEY,
HENRY J. GUY.